PROGESTERONE AND OESTRADIOL LEVELS DURING OESTROUS CYCLE AND OESTRUS SYNCHRONIZATION IN GOATS

By

Massita Binti Nordin

Thesis submitted to the University of Malaya for the degree of Master of Philosophy

INSTITUTE OF POSTGRADUATE STUDIES
UNIVERSITY OF MALAYA
KUALA LUMPUR
NOVEMBER 2003

ACKNOWLEGEMENTS

Many people gave assistance to me during the writing of this thesis, but it is to Prof. Dr. Ramli Abdullah, that I am most deeply indebted and whom I must thank first. For six years he gave unstintingly of his valuable advice, times and encouragement. I would also like to gratefully acknowledge invaluable help from the ABEL staffs, staff of the IPS Farm and friends who helped me in a variety of ways.

I owe a special debt to my parents, for their encouragement, love and who have patiently waited for the completion of this thesis. To my husband, Abg Zul, with all my heart and love, for all that you are and do and mean to me. Your encouragement and belief sustained me at all times. To my precious sweet love, Imran Baqthiar and Kasih Allysya, you are the heartbeat of my life. For you and your Daddy, my love and my life will forever be yours.

LIST OF TABLES

LIST OF FIGURES

FIGURE **PAGE**

FIGURE **PAGE**

LIST OF PLATES

LIST OF APPENDICES

ABSTRACT

The main objectives of this study were to understand the mechanism of hormonal control of reproduction, with the hope to overcome problems relating to abnormal reproductive status in goats. The aim was also to compare between the normal and abnormal goats with reference to hormone secretion during oestrous cycles and to characterize the patterns of progesterone and oestradiol hormones in the blood of different goat genotypes with normal and abnormal oestrous cycles and after oestrus synchronization. In the first hormonal study, blood samples were collected daily during oestrous cycle between 0700 to 0800 hours every morning for 50 consecutive days from 25 mature female goats of different genotypes, namely the Katjang goats (5 animals), Jermasia goats (10 animals) and Boer crossbred goats (10 animals). In the second experiment, blood samples were collected from 5 mature female goats from Jermasia genotype daily, every 8 hours that is 2 days before oestrus until 2 days after oestrus and in the third experiment blood samples were collected daily between 0700 hours to 0800 hours from 15 mature female goats of three different genotypes namely, Jermasia goats, Boer crossbred and mixed bred goats which has undergone oestrus synchronization. All the sera were analyzed for progesterone and oestradiol hormones using the radioimmunoassay (RIA) procedure. It was observed that Jermasia goats with longer oestrous cycle showed higher mean progesterone levels (4.03 ng/ml) and lower mean oestrogen levels (0.92 pg/ml) , respectively. In Boer crossbred goats, the mean progesterone levels did not show any obvious pattern. However, oestradiol level was generally higher in longer oestrous cycle (7.61 pg/ml). In Katjang goats, the same trend of higher progesterone level was observed, coinciding with longer oestrous cycle, as was seen in Jermasia. For goats which showed long oestrous cycle, dioestrus durations lengthened from 16 to 24 days whereas proestrus period had also increased to 4 to 6 days. Metoestrus period maintained between 3 to 4 days for both normal and long oestrous cycle goats. Similar trend was observed as in normal oestrous cycle goats, where goats with longest oestrous cycle had the longest dioestrus period. Goats with shortest oestrous cycle (17 days) had the shortest dioestrus period, that is, 13 days. Among the anoestrus female,

hormone profile of this individual showed undetectable progesterone levels and extremely high oestradiol levels. In intensive studies to determine the hormonal pattern, after day -2, progesterone levels (1.12 ng/ml) declined significantly ($P \leq 0.05$) (that is, on day –1, day 0 and day 1) with the values of 0.05 ng/ml, 0.01 ng/ml and 0.03 ng/ml, respectively, and started to increase again on day 2 (0.30 ng/ml). On day –2, oestradiol level was 0.54 pg/ml and increased significantly and reached the peak at day –1 (1.87 pg/ml). From then on, oestradiol levels declined to 0.17 pg/ml on oestrus day ($P \leq 0.05$) and later to undetected level (0.00 pg/ml). It was observed that the period between the oestradiol peak (2.62 pg/ml) on day -1 at 0700 hours and the detection of oestrus on day 0 at 0700 hours, which was approximately 24 hours. In the third hormonal treatment experiment, it was observed that progesterone levels started to rise immediately after implantation. In Jermasia goats, progesterone level was highest on day 6 (11.02 ng/ml) while Boer crossbred goats and mixed bred goats peaked on day 3 (6.81 ng/ml and 5.81 ng/ml). The progesterone levels were then maintained throughout the period the implant was in place. The insertion of CIDR implant caused a slight drop in oestradiol levels. When the CIDR implant was removed from the animals, the progesterone levels started to decline from 6.48 to 2.55 pg/ml, 2.54 to 0.01 pg/ml and 2.56 to 0.02 pg/ml in Jermasia goats, Boer crossbred goats and in mixed bred goats, respectively. It can be concluded that all the animals with normal and abnormal oestrous cycle, showed the classical hormone patterns. However, it was observed that the latter group of goats with long oestrous cycle showed longer dioestrus period, whereas goats with shortest oestrous cycle had the shortest dioestrus period. In some of the goats which showed abnormal oestrous cycle, alternating peaks of oestradiol and progesterone were also observed.. In intensive studies to determine the hormonal pattern of the female goat, 2 days before oestrus until 2 days after oestrous, it has been shown that oestradiol level started to rise two days prior to oestrus. The period between the oestradiol peak and the detection of oestrus was approximately 24 hours. In the oestrus synchronization study, it was observed that all the animals used in this study showed the sign of oestrus 24 to 72 hours after the removal of the CIDR implant.

ABSTRAK

Objektif utama kajian ini dijalankan adalah untuk memahami mekanisma kawalan hormon pembiakan bagi membolehkan kita menyelesaikan banyak masalah yang berkaitan dengan status pembiakan kambing betina yang tidak normal. Matlamat kajian adalah untuk membandingkan rembesan hormon progesteron dan estradiol ketika kitar estrus, dalam kambing betina dari baka yang berlainan yang mempunyai status pembiakan yang normal dan tidak normal dan juga selepas estrus disinkronikan. Dalam eksperimen yang pertama, sampel darah dikumpulkan setiap hari selama 50 hari berturut-turut diantara jam 7 pagi hingga 8 pagi dari 25 ekor kambing betina matang dari baka yang berbeza iaitu kambing Katjang (5 ekor), kambing Jermasia (10 ekor) dan kambing kacukan Boer (10 ekor). Dalam kajian yang kedua, sampel darah dikumpulkan dari 5 ekor kambing betina matang dari baka Jermasia (5 ekor) setiap hari dan setiap 8 jam selama 2 hari sebelum estrus sehingga 2 hari selepas estrus.Dalam kajian ke tiga, sampel darah dikumpul setiap hari antara jam 7 pagi dan 8 pagi dari 15 ekor kambing betina dari baka yang berbeza iaitu Jermasia, kambing kacukan Boer dan kambing kacukan campuran. Kesemua haiwan betina dalam ujikaji yang ketiga ini disinkronikan estrus. Kesemua sampel darah yang dikumpul akan dianalisis untuk hormon progesteron dan estradiol menggunakan teknik radioimmunoasai (RIA). Dari kajian yang telah dijalankan didapati kambing Jermasia yang mempunyai kitar estrus yang panjang menunjukkan purata paras progesteron yang tinggi (4.03 ng/ml) dan purata paras estradiol yang rendah (0.92 pg/ml). Bagi kambing kacukan Boer, purata paras progesteron tidak menunjukkan corak yang sama. Paras estradiol secara umumnya adalah lebih tinggi dalam kitar estrus yang lebih panjang (7.61 pg/ml). Bagi kambing Katjang, corak paras progesteron yang tinggi juga dapat diperhatikan bagi kitar estrus yang panjang seperti kambing Jermasia. Bagi kambing yang mempunyai kitar estrus yang panjang, tempoh diestrus adalah diantara 16- 24 hari manakala proestrus pula adalah diantara 4-6 hari. Tempoh metestrus adalah diantara 3-4 hari bagi kambing yang mempunyai kitar estrus yang normal dan juga tidak normal. Corak yang sama juga dapat diperhatikan bagi kambing yang mempunyai kitar estrus yang normal dimana kambing yang mempunyai kitar estrus yang terpanjang dalam kitar normal akan menunjukkan tempoh diestrus yang panjang. Manakala kambing yang mempunyai kitar estrus yang pendek (17 hari) menunjukkan tempoh diestrus

ynag juga pendek (13 hari). Bagi kambing yang tidak menunjukkan tanda-tanda estrus (anestrus) profile hormon individu ini menunjukkan paras progesteron dan estradiol yang sangat tinggi. Didalam ujikaji yang kedua, didapati paras penurunan progesteron (1.12 ng/ml) menunjukkan perbezaan yang bererti ($P<0.05$) (iaitu pada hari –1, 0 dan 1) dengan nilai 0.05 ng/ml, 0.01 ng/ml dan 0.03 ng/ml. Paras progesteron mula meningkat semula pada hari 2 (0.30 ng/ml). Pada hari –2, paras estradiol adalah 0.54 pg/ml dan peningkatannya juga menunjukkan perbezaan yang bererti dan mencapai paras tertinggi pada hari –1 (1.87 pg/ml). Selepas hari –1, paras estradiol menurun semula kepada 0.17 pg/ml pada hari estrus ($p\leq 0.05$) dan kemudian kesuatu paras yang sangat rendah (0.00 pg/ml). Diperhatikan juga tempoh diantara paras estradiol tertinggi (2.62 pg/ml) pada hari –1 dan estrus pada hari 0 adalah lebih kurang 24 jam. Dalam ujikaji ketiga didapati paras progesteron mula meningkat serta merta selepas dimasukkan CIDR implan. Kambing Jermasia mempunyai paras progesteron yang tertinggi pada hari 6 (11.02 ng/ml), kambing kacukan Boer pada hari ke3 (6.81 ng/ml) dan kambing kacukan campuran pada hari ke 3 (5.81 ng/ml). Paras progesteron dikekalkan pada keseluruhan tempoh CIDR implan berada didalam vagina kambing. CIDR implan menyebabkan kejatuhan paras hormon estradiol. Apabila CIDR implan dikeluarkan dari kambing, paras progesterone menurun dari 6.48 ng/ml ke 2.55 ng/ml dalam kambing Jermasia, 2.54 ng/ml ke 0.01 ng/ml dalam kambing kacukan Boer dan 2.56 ng/ml ke 0.02 ng/ml dalam kambing kacukan campuran. Kesimpulannya, kesemua haiwan yangmempunyai kitar estrus normal dan tidak normal menunjukkan corak hormon yang klasikal . Walau bagaimanpun bagi haiwan yang mempunyai kitar estrus yang panjang, menunjukkan tempoh diestrus yang panjang manakala kambing yang mempunyai kitar estrus yang pendek mempunyai tempoh diesrus yang pendek. Kambing yang mempunyai kitar estrus yang tidak normal menunjukkan paras hormon progesteron dan estradiol yang tidak tetap. Dalam kajian terperinci yang dijalankan, didapati paras estradiol mula meningkat 2 hari sebelum estrus. Tempoh diantara paras estradiol tertinggi dengan estrus adalah lebih kurang 24 jam. Dalam kajian yang melibatkan kambing yang telah disinkronikan kitar estrusnya, didapati kesemua kambing yang digunakan telah menunjukkan tanda-tanda estrus 24 hingga 72 jam selepas CIDR implan dikeluarkan.

TABLE OF CONTENTS